multiple chemicals." Thus the OSHA standard reverted back to 100 ppm. The EPA rule calls for a reduction in perc emissions and is the first national emissions standard for hazardous air pollutants (NESHAP) issued by EPA to regulate 189 toxic chemicals under the 1990 Clean Air Act.

The new EPA rule applies to businesses that gross more than $75,000 a year and bans new purchases of transfer machines, which consist of separate washers and dryers. All cleaners are required to install dry-to-dry machines when existing equipment is replaced, which combine washing and drying in the same place and emit considerably less perc. EPA expects the rule will cut fugitive perc emissions in half. For large dry cleaners that potentially emit 10 tons of perc a year, room enclosures will be required for transfer operations of solvent-laden clothes from washers to dryers.

According to the U. S. International Trade Commission, nearly 242,000 pounds of perc were produced and used in the United States in 1992. In the first half of 1993, close to 154,000 pounds were manufactured, representing a 27% increase. In addition to use as a dry-cleaning solvent, perc is used for metal degreasing, as a general solvent, and has been used against nematodes and trematodes in animals and humans.

According to an EPA source, the agency considered seeking an extension of the court deadline for the final rule to more fully investigate perc issues. However, administrators believed such a delay would have postponed the health and environmental benefits of the rule for an extended and unacceptable period of time. EPA determined that the best environmental protection would be achieved by issuing the rule as expeditiously as possible and deciding subsequently how to best address remaining indoor air pollution and groundwater contamination associated with perc dry cleaners. To that end, EPA convened a public meeting November 3–4 at the New York-Pennsylvania Hotel in New York, which was attended by 90 people.

Lyme Vaccine Makes Outdoors Safe Again

Lyme disease has stricken 50,000 Americans since it was discovered in 1976. Now a group of researchers at Yale University have developed a vaccine against Lyme disease that may allow people living in high-risk areas to again enjoy the outdoors.

"You constantly have to think about it; you worry when your grandchildren go outside, and do tick checks every night," said Ellen Jacko of Block Island, Rhode Island, where the vaccine will be tested. "I'm old enough to remember polio. It reminds me of the way parents were afraid to let kids go into the swimming pool."

Although Lyme disease is easily treated early in the course of the illness, its first symptoms are often overlooked. In later stages Lyme can produce neurologic problems, arthritis, and abnormal heart rhythms. Alan Elwell, a resident of Block Island, said that one of his sons missed a year of school due to paralysis from Lyme and a second son was rushed to the hospital with heart problems from the disease. "We all have our horror stories," he said.

The disease is a major problem in areas where ticks, small rodents, and deer are prevalent. Many people in the coastal Northeast have been infected, as well as people in parts of New Jersey, California, and Minnesota. On Block Island, which is mostly wild and undeveloped and is home to more than 700 deer, 1 in 20 people contract Lyme disease each summer.

Because people who contract Lyme disease and recover without the aid of antibiotics are immune to subsequent infections, researchers knew it was possible to develop a vaccine. The problem was that some of the worst symptoms of the disease were believed to be due to an over-agressive immune response, making it impossible to use the whole spirochete organism to produce the vaccine.

Researchers quickly focused their attention on a protein of the spirochete that causes Lyme. The protein, called OSP-A, was isolated, its gene cloned and inserted into *E. coli*, and the protein mass produced by the bacteria. Tests in animals showed that the vaccine made from this protein not only cured the disease, it cured any infected ticks on the animal.

"This is a vaccine that works in a unique way," said Andrew Spielman of the Harvard School of Public Health. "It kills the organism in the gut of the tick when it ingests a blood meal."

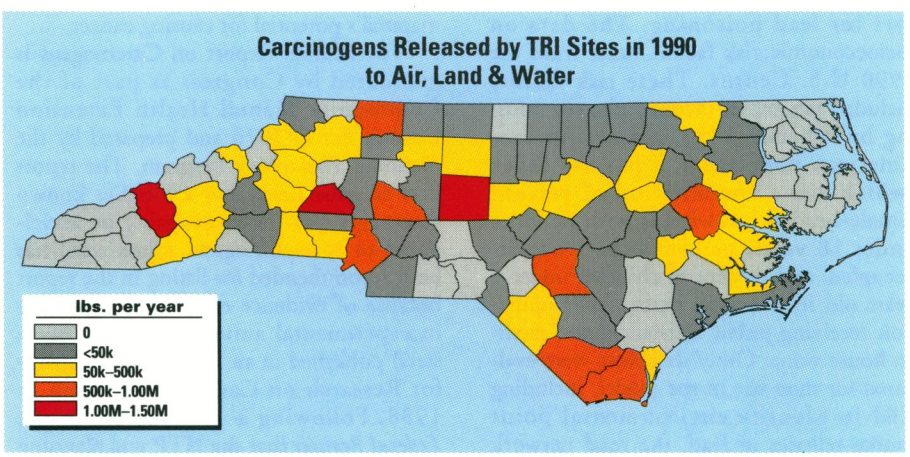
So far, testing suggests that the vaccine does not provoke aberrant immune reactions thought to contribute to Lyme arthritis and neurologic effects of the disease such as Bell's palsy, a temporary paralysis of the facial muscles. Although some people treated with the OSP-A vaccine have produced unusually high levels of antibodies, Fred Kantor of Yale University believes that these high levels of antibodies simply indicate that such people have been infected for a long time and have organisms in areas of their bodies where the immune system cannot get to them.

"Could the vaccine cause a chronic relapsing disease or an adverse reaction?" said Kantor. "I suppose it could, but the evidence is that it doesn't happen. I feel the chances of a problem are remote enough that I will be happy to take it."

Mapping out Health

Researchers at NIEHS have been exploring a system that uses geographic information for environmental health research. A geographic information system (GIS) may potentially be used to characterize environmental exposures in relation to demographic variables for specific population groups, identify populations at high risk for environmental disease to target prevention programs, and analyze environmental epidemiological data to generate or test specific hypotheses. A recent seminar organized by NIEHS and the North Carolina Department of Environment, Health and Natural Resources (NCDEHNR) brought researchers from local universities and other organizations together to discuss research involving GIS.

A GIS can be defined as a computer system of hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modeling, display (mapping), and output of data by geographic location. For any application there are five generic questions that



Brent Cooke

Toxic towns. Geographic information systems enable researchers to follow trends in environmental health.